# COMP9414 FINAL SAMPLE

`UNSW` `COMP9414`

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**Outline** egP583/P304 指原书583页/中文书304页
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# Year 2000

## Q1

- 5 types of agent:
  - **Reactive Agent** :do not have memory
  - **Model-Based Agent** : have past memory, but cannot planning base on the past
  - **Planning Agent** : can plan the furture，but not flexible in adapting to new situations.
  - **Game Playing Agent**: have opponent
  - Learning Agent:

## Q2

- A)
  - Operator:
    - Move up / down / left / right to the end.
  - Strategy:
    - DFS
  - Reason:
    - Through BFS can find the shortest way, it costs memory .Because there are 2 routes in the map that allow us to reach the possible exits using the operator mentioned above (the first 2 exits).
- B)
  - The cost of heuristic function from n to goal is always smaller or equal to the

actual cost from n to goal.

- C)
  - $h = |X - X_G| + |Y - Y_G|$

## Q3 缺图

## Q4

- diffence between Function symbol & Predicate symbol

| | |
|---|---|
| Constants | $Gold, Wumpus, [1,2], [3,1]$, etc. |
| Predicates | $Adjacent(), Smell(), Breeze(), At()$ |
| Functions | $Result()$ |
| Variables | $x,\ y,\ a,\ t, \ldots$ |
| Connectives | $\wedge\ \vee\ \neg\ \Rightarrow\ \Leftrightarrow$ |
| Equality | $=$ |
| Quantifiers | $\forall\ \exists$ |

A)
Constant:
Variable: x, y
Function symbol: father, mother
Predicate symbol: Rich, Well_off, Older

B)
i)

x is variable
AI, Smart are predicates

ii)

x is variable
AI is predicate
sister is function

iii)
x is variable

Higher is predicate
score is function
Sandra, Peter are constants

## Q5

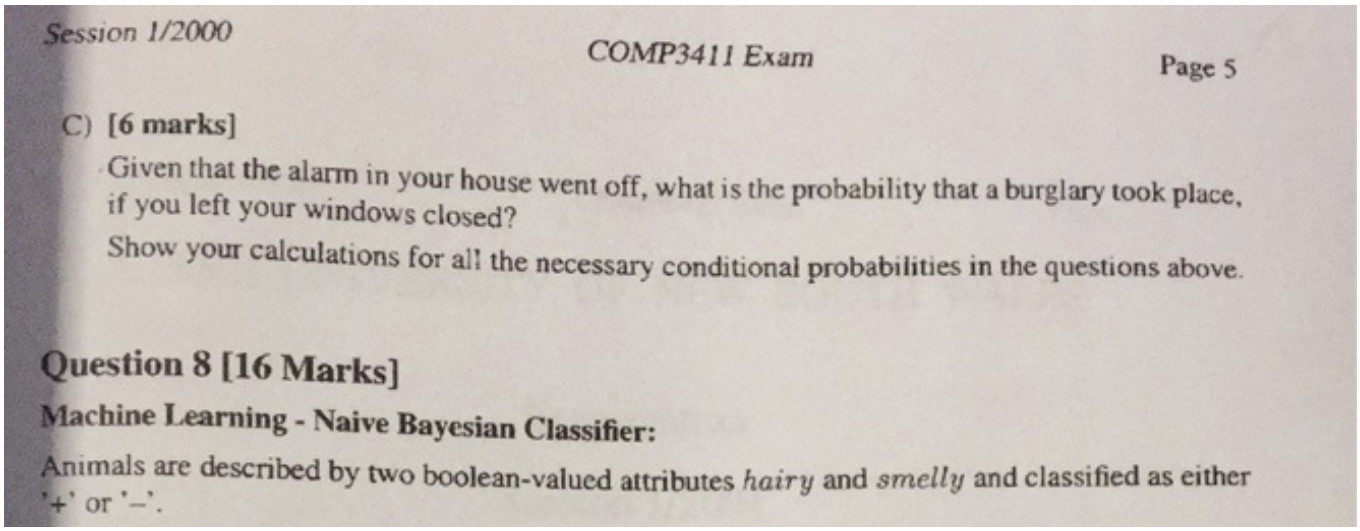
pass

## Q6

pass

## Q7 缺图

## Q8



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C) **[6 marks]**

Given that the alarm in your house went off, what is the probability that a burglary took place, if you left your windows closed?

Show your calculations for all the necessary conditional probabilities in the questions above.

**Question 8 [16 Marks]**

**Machine Learning - Naive Bayesian Classifier:**

Animals are described by two boolean-valued attributes *hairy* and *smelly* and classified as either '+' or '–'.

Given are the following training examples:

| No | hairy | smelly | class |
|---|---|---|---|
| 1 | n | n | – |
| 2 | n | y | – |
| 3 | y | y | – |
| 4 | n | n | – |
| 5 | n | y | + |
| 6 | y | n | + |

$P(+) = \frac{1}{3}$, $P(-) = \frac{2}{3}$

$P(\text{hairy}|+) = \frac{1}{2}$ $\quad P(\text{hairy}|-) = \frac{1}{2}$.

$P(\neg\text{hairy}|+) = \frac{1}{2}$ $\quad P(\neg\text{hairy}|-) = \frac{3}{4}$

$P(S|+) = \frac{1}{3}$ $\quad P(S|-) = \frac{2}{3}$

$P(\neg S|+) = \frac{1}{3}$ $\quad P(\neg S|-) = \frac{1}{3}$

A) **[10 marks]**

Estimate the probabilities needed for a Naive Bayesian classifier.

B) **[6 marks]**

Which class would the Naive Bayesian classifier assign to the following two animals?

| No | hairy | smelly | class |
|---|---|---|---|
| 7 | n | n | ? |
| 8 | y | n | ? |

$P(X|+) = P(x_1|+) \cdot P(x_2|+) \cdots P(x_n|+)$.

<1>

① $P(\neg\text{hairy} \wedge \neg\text{smelly}|+) = \frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$.

② $P(\neg H \wedge \neg S|-) = \frac{3}{4} \times \frac{2}{3} = \frac{1}{2}$

$P(X|+) \cdot P(+) = \frac{1}{36}$

$P(X|-) \cdot P(-) = \frac{1}{3}$

∴ 7 → ⊖.

<2>

$P(HSX|+) = \frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

$P(HSX|-) = \frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$.

∴ 8 → ⊖.

$P(X|+) \cdot P(+) = \frac{1}{18}$

$P(X|-) \cdot P(-) = \frac{2}{9}$.

# Year 2001

## Q1

pass 看2000 Q1

## Q2

什么傻逼题

## Q3

A)
Minimax function

B)
pass

C)
How alpha beta pruning works?
Alpha beta pruning stops completely evaluating a move when at least one possibility has been found that proves the move to be worse than a previously examined move. Such moves need not be evaluated further.

Why?
Because if the successor nodes are worse than the given node, we do not need to evaluate them anymore and prune them, otherwise, we should continue to evaluate them.

How?
Just stop evaluate those nodes which perform worse than the previous given node.

## Q4

- 题目是不是多了一个Y没用到
- A)
  - Constant:
  - Variable: x, y, z
  - Function symbol: Lover, Parent
  - Predicate symbol: Pretty, Happy
- B)
  - For all people and his / her parent, if he / she is pretty, the parent and his / her lover are both happy.

## Q5

pass

## Q6 缺

- A)
  - X = 1,
  - Y = [2, 3];
  - X = 2,
  - Y = [1, 3];
  - X = 3,
  - Y = [1, 2]
- B)

```
// part1
p(X,[X|Y],Y).
p(X,[W|Y],[W|Z]):-
    p(X,Y,Z).

```

```
// part2
perm([],[]).
perm([X],[X]):-!
perm([W|Y],[X]):-
    perm(Y,Y1),
    p(Z1,Z2,Y1),
    p(Z1,[W],X1),
    p(X1,Z2,X),


```

## Q7

pass

## Q8

① colour
- Green : 2 YES
- Normal : 1 NO
- White : 1 YES / 1 NO

$E = \frac{2}{5}(0) + \frac{1}{5}(0) + \frac{2}{5}\left(-\frac{1}{2}\log\frac{1}{2} - \frac{1}{2}\log\frac{1}{2}\right)$

$= \frac{2}{5}$.

⋮

② Exam
- NO : 2 YES
- YES : 1 YES / 2 NO.

$E = \frac{2}{5}(0) + \frac{3}{5}\left(-\frac{1}{3}\log\frac{1}{3} - \frac{2}{3}\log\frac{2}{3}\right)$

$= 0.459$.

∵ $E_{color}$ 最小 ∴ 取 color

- B)
  - A full-growth tree without pruning will be easily overfitting to the training data.
  - Just using entropy (information gain) to spit tree will tend to choose those attribute that have more values.
- C)
  - Use pruning algorithm before or after the tree construction.
  - Use information gain ratio, or Gini index rather than information gain to split each branch during tree construction.

# Year 2002

## Q1

- A)
  不会做
- B)
  - i) Informed search uses evaluation function during path searching, while uninformed search can just distinguish whether the current state is goal or not.
  - ii)The cost of heuristic function from n to goal is always smaller or equal to the actual cost from n to goal.

A* uses evaluation function f(n)=g(n)+h(n)
g(n) = cost from initial node to node n
h(n) = estimated cost of cheapest path from n to goal
f(n)=estimated total cost of cheapest solution through node n

- C)
  - Forward checking is to keep track of remaining legal values of unassigned variables.
- D)
  - Least constraining value is to choose the least constraining value when given a

variable.
The intuition reason is that we should save as many values as possible when we decide to use these values to fill in one variable.

## Q2

A)
Constant: Eva
Variable: x, y
Function symbol: friend, child
Predicate symbol: Cool, Greater, Friendly, Friendlier

B)
i)

x is variable
AtUNSW, GreenHair are predicates
student is function

ii)

x is variable
BlueHair, CountIsTwo are predicates
student is function

iii)

x is variable
Tailor, MakeDresses, MakeShoes are predicates

## Q3

pass

## Q4

A)
i)
X = b

ii)
false

B)
i)
X = d
Y = f;

X = d
Y = h;

X = f
Y = g;

X = g
Y = h;

X = h
Y = i

ii)
Y = g;
Y = h;
Y = i

C)
不会做

## Q5

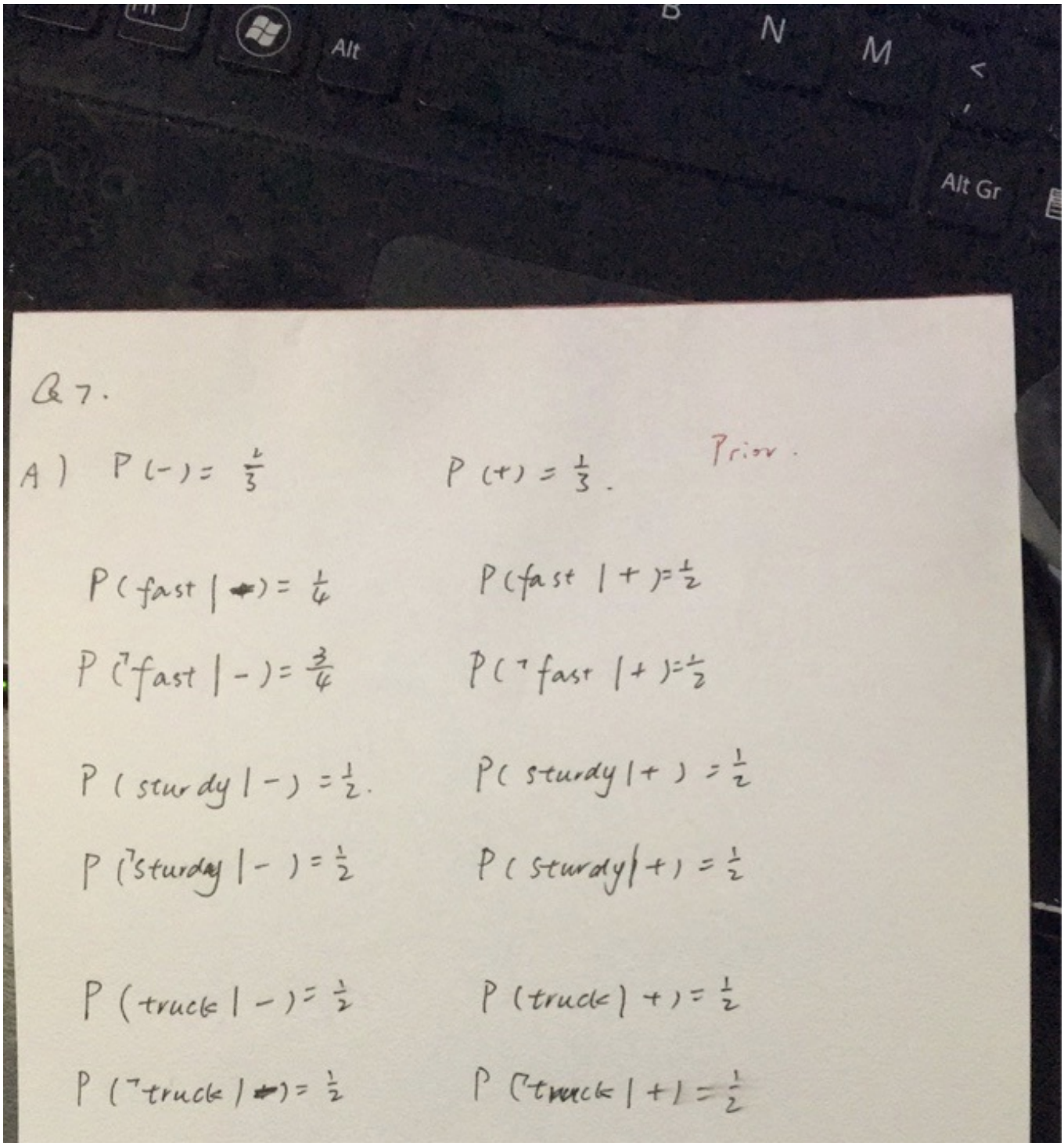
pass

## Q6

pass

## Q7

- GARY/NEW



B) $P(x|-)$

$P(\neg fast \wedge sturdy \wedge truck \mid +) = \frac{3}{4} \times \frac{1}{2} \times \frac{1}{2} = \frac{3}{16}$

$P(x|+)$

$P(\neg fast \wedge sturdy \wedge truck \mid -) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$

$P(x|-) \cdot P(-) = \frac{3}{16} \times \frac{2}{3} = \frac{1}{8}$

$\therefore ?$

$P(x|+) \cdot P(+) = \frac{1}{24}$

$P(x|-)$

$P(fast \wedge sturdy \wedge \neg truck \mid -) = \frac{1}{4} \times \frac{1}{2} \times \frac{1}{2}$

$\therefore 8$

$P(x|+)$

$P(fast \wedge sturdy \wedge \neg truck \mid +) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$

$P(x|-) \cdot P(-) = \frac{1}{24}$

threshold

$P(x|+) \cdot P(+) = \frac{1}{24}$